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LAN network architecture design at Nurul Jalal Islamic Boarding School, North Jakarta

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Article Info	ABSTRACT
	A computer network is a telecommunications network that allows computers to communicate with each other by exchanging data. At Nurul Jalal Islamic Boarding School, they have taken advantage of advances in computer network technology, but have not been fully connected properly. Therefore, in this research, a local area network (LAN) network architecture that is connected to speedy internet will be built and developed. The design of this network architecture includes designing a connection to the internet speedy network and designing a computer lab architecture that is connected to the network at the Nurul Jalal Islamic Boarding School. This study aims to design the existing technology with the system and add technologies and systems that do not yet exist so that they can be integrated into a computer network connected to the speedy internet network. It is hoped that this research will help teachers and students of Nurul Jalal Islamic Boarding School in exploring information so that it can help effective and efficient learning.

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1. INTRODUCTION

Information technology and science in the field of communication continue to develop to keep up with the changing times so that the role of today's communication technology seems to have become a necessity in everyday life, one example of advances in communication technology is the transmission medium which is always used in computer network infrastructure besides that. A wired network is an advance in wireless local area network (LAN) technology or what is commonly called wireless local area network (WLAN) is a network technology that utilizes radio waves as a medium for interaction/communication between computers or it can be said that cables cannot be used as a distribution (transmission) method [1]–[3].

The use of this technology has started in many institutions and even businesses that have used computer networks to accelerate the flow of information and improve performance within institutions or companies [4]. The use of communication technology in an educational institution is required for all educational institutions, both public and private, to provide information about their activities, which usually includes several aspects such as school academic information, school financial management, school administration, school staffing, infrastructure, and school relations with the surrounding community, which is expected to improve the quality of proper vocational education in accordance with the National Education

Standards Agency (BNSP) in implementing the minister of national education regulation number 40 of 2008 concerning standards for facilities and infrastructure for vocational high schools/madrasah aliyah vocational schools (SMK/MAK) [5]. To meet the needs for using computer networks in SMKs, the concept of designing an SMK computer network architecture must be prepared by creating a framework or framework arrangement regarding architectural processes that can support the Minister of National Education Regulation number 40 of 2008 concerning school facilities and infrastructure [6].

Nurul Jalal Islamic Boarding School is one of the Islamic boarding schools in the city of Jakarta that has a computer but does not have a computer network, each machine still uses hardware such as a flash drive to transfer data, to print data using a printer that is only available on certain machines. Since only a few computers have an internet connection, it is difficult to get accurate references from online media. Based on research, it is said that the existence of computer network media, will help organizations improve resource management more efficiently, work groups communicate more efficiently, and maintain data security more securely so that the organization can achieve its goals of improving the quality of the organization [7]. Meanwhile, based on other research, it is said that with computer network media, you can easily access and share the necessary data, simplifying the work process and collaboration between individuals or departments through the communication process with various media including text messages, images, video, and audio. To implement this implementation, mapping of network topology and internet protocols that are appropriate to the location/object of implementation is required, so based on this research, resolving the problems experienced by the Nurul Jalal Islamic Boarding School, requires the utilization and use of computer network technology. For this reason, the authors designed a LAN network architecture at the Nurul Jalal Islamic Boarding School, North Jakarta.

2. RESEARCH METHOD

For research to be carried out properly and in accordance with what the author expects, real data is needed and the data must be in accordance with what is needed because this data is very important. In order to obtain the requested data and information, can be obtained from the chairperson of the Nurul Jalal Islamic Boarding School. In this case, the author uses data collection methods through observation [8], interviews, and literature from other studies that can be used as relevant references [9], [10]. Meanwhile, the application of this technology uses a prototype development method which consists of user needs analysis, system creation and system testing, research evaluation, and implementation [11]–[13]. The following is a depiction of this method in Figure 1.
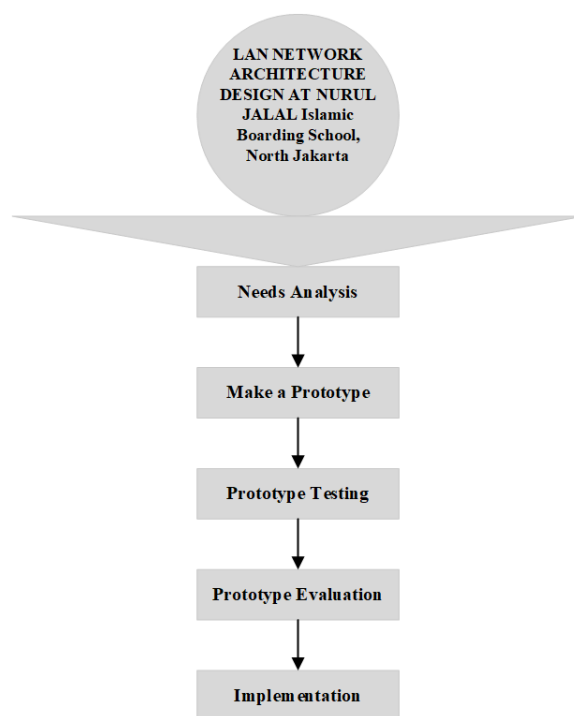

Figure 1. Prototype development method

The explanation of this method is as follows: i) Analysis of user needs, in this case the needs of the Nurul Jalal Islamic boarding school are how to make it easier to send data, and how all devices can be connected to the internet; ii) Make prototype, so in this case the researcher built a LAN network with a star network topology; iii) Prototype testing, each device will be connected to a computer device which is used as a server, so to carry out testing, apart from the server computer it will be tested by sending data and accessing the internet; iv) Prototype evaluation, what is done is to run all devices in each different division or department at the same time, whether the function of sending data and internet access can be carried out well, if it does not work well, then improvements will be made to the network again; and v) Implementation, if the network technology has gone through the repair phase and been tested again and obtained error-free results, then the technology is ready to be implemented on that object.

3.   RESULTS AND DISCUSSION
3.1. Design draft framework of thought
Simplifying the design of LAN architecture requires a framework for mapping technological solutions based on problems that occur, and are used as a basis for implementing a technology [14]. The importance of applying a thinking framework is to map problems and solutions that are supported with the help of technology. This framework of thinking is divided into 5 objects, namely the boarding school leadership room, administration room, teacher's room, study room, and practice room.

The thinking framework also describes solutions through the application of technology such as computers, transmission media, network topology, and network design. These components are needed in building LAN technology. In previous research, it was stated that there are 3 main categories of equipment needed, including computers, cables as a transmission medium, and network topology as a logic component in connecting computers [15]. The collection of these components is intended to make it easier for network administrators to build network technology on a scale linking these 5 objects. Meanwhile, the impact of the solution must be described to clarify the purpose of creating the technology, and who it will use, making it easier to carry out testing of the technology being built [16]. The framework design is a tool used to design the structure and direction of thought to be used in a study [4]. In the process of designing the LAN network architecture data is needed to determine the network used. The following is a network system design framework at the Nurul Jalal Islamic Boarding School as shown in Figure 2 [17]–[19].
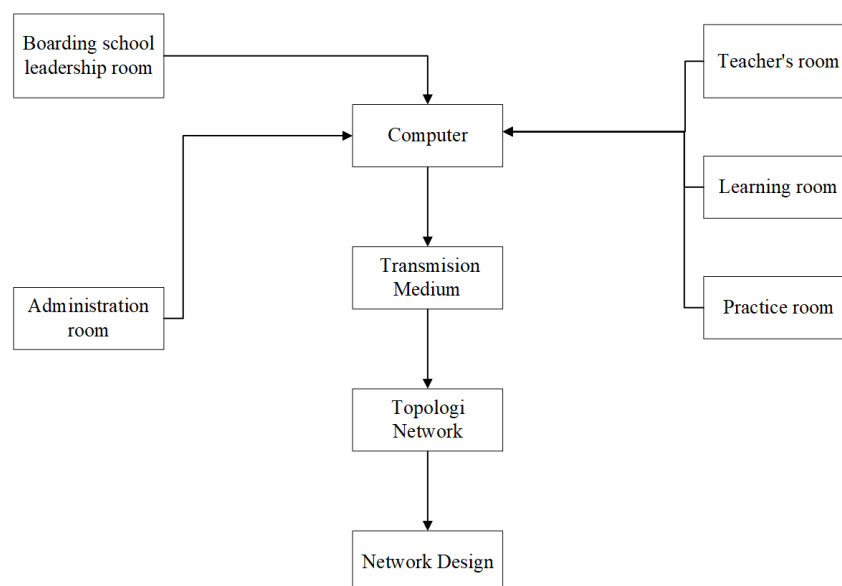

Figure 2. Framework design

3.2. Topology network
The purpose of a network topology is to connect several devices by forming a computer network by mapping the devices via computer media, cables, connectors, and different specifications [20]. The aim of the solution built on the research object, namely Nurul Jalal Islamic Boarding School, is how to create ease of application of technology and how to control access to information in each section. The most possible

network topology is a star topology, where this topology is centralized control, and all links must pass through a center that distributes the data to all parts or clients of their choice. The central part is called the primary station or server and the other is called the secondary station or client server. After the network connection is initiated by the server, each client-server can use the network connection at any time without waiting for orders from the server [21]. The advantages of this topology can answer the problems faced, namely flexibility, a high level of data security, easy-to-detect damage to the network and if one computer is damaged, the network will continue to run, and not cause problems for other computers [22].

In designing a LAN network architecture, a topology is needed that describes the network structure or how a network is connected [19], [23], [24]. In designing the network at Nurul Jalal Islamic Boarding School, star topology is used. Star topology is a type of network topology that involves the convergence of data from one node to the next. Each workstation is directly connected to a server or hub/switch. In this topology, a hub/switch is used to connect one computer [25]–[27]. The advantages of using a star topology include: easy layout and cabling, will not interfere with network performance if there are additions or reductions of terminals, and easy network processing. The disadvantage of using a star topology, is wasteful in the use of cables [28], [29]. So, the following is a depiction of the star network topology as shown in Figure 3.
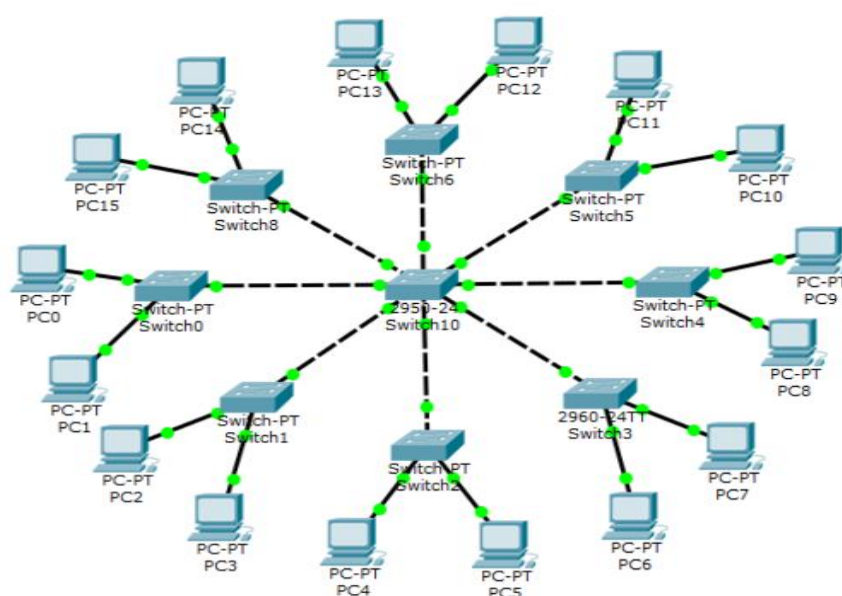

Figure 3. Star topology

3.3. Local area network

Based on the research object, each connected device is still in the same location, so the implementation that will be applied is a LAN network. LAN is a computer network that connects one computer or one workstation to another, such as at home or in the office. Distances are limited to a few kilometers, with connection speeds ranging from 2 to 10 megabytes per second. The advantages of using a LAN: access to data between computers is fast and easy, many computers are connected to the internet, and backing up data takes place more quickly and easily [30].

3.4. Network system design

Network system design is an important planning process to implement an effective and efficient computer network [31]–[33]. The system network design used is a LAN network. The purpose of the LAN network is to connect several devices in the same location, making it easier to control access. LAN networks can be built using the wired method. Wired LANs are built using ethernet and wireless LANs are built using a Wi-Fi signal. The router here is useful as a connection center and allows devices such as cell phones, computers, laptops, and tablets to be connected. The router is usually connected to a cable or modem that has internet access on the connected devices. Figure 4 shows the network system design that will be implemented at the Nurul Jalal Islamic Boarding School.
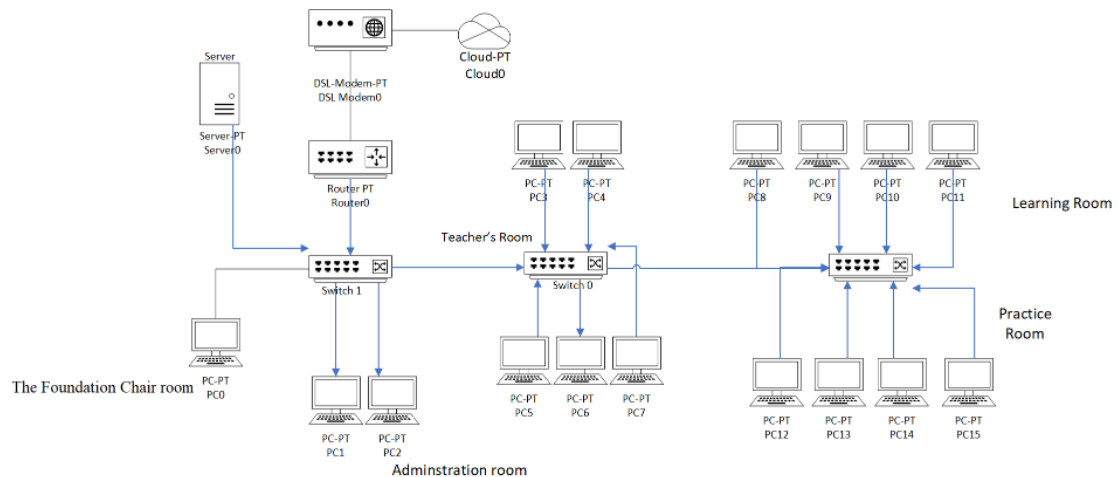
Figure 4. LAN design

In the design shown in Figure 4, it consists of 5 groups, namely the foundation chair room, administration room, teacher room, learning room, and practice room. Each group will be connected to a switch. The function of the switch itself is to connect devices in the same network/group, in this case, there are 3 switches connected, 1 switch connecting the foundation and administration chair group, 1 switch for the teacher group, 1 switch for the study group, and 1 fruit switches for group practice. So that each group can communicate, it needs a router. The function of a router is to connect networks/groups in one area, so each switch is given 1 router as a link so that groups can access the internet and use the printer simultaneously. The stages in implementing it are as follows.

a. Set the modem to the ZTE modem type. This type of device functions as a router and switch. The settings are given an internet protocol (IP) with the address 192.168.1.1, then enter username: user and password: user. The following display of the ZTE Modem can be seen in Figure 5.
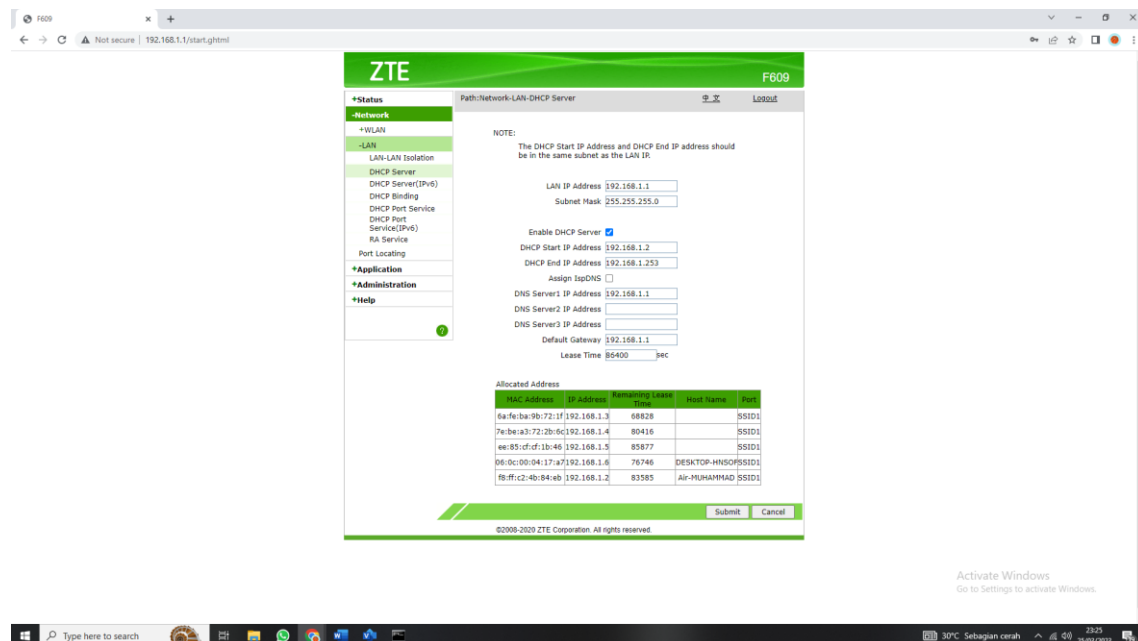
Figure 5. ZTE modem setting results

b. Set up each device in the group. Applying IP is very important to provide the address of the device. The function of IP is the standards or rules used in networks to regulate and allow connections between

computers and the transfer of data. Internet protocols are marked with a number on each octet which is marked with a dot. Table 1 shows the address of each device, both for the server and the user. Meanwhile, additional information on all devices can be seen in Table 2. The steps to set IP are: i) right-click on your network icon, ii) select "open network and sharing center", iii) then click on the network you are using, iv) then select "details.", and v) then enter the number in the IPv4 Address section, how to enter the number for each device can be seen in Figure 6.

Table 1. Default gateway

Computer	IP Address
Computer server	192.168.10.2
Computer the foundation's president	192.168.10.3
Computer administration	192.168.10.4 to 192.168.10.5
Computer teacher	192.168.10.6 to 192.168.10.10
Computer practice	192.168.10.11 to 192.168.10.18

Table 2. Additional information

Information	IP Address
Gateway	192.168.10.1
Subnet mask	255.255.255.0
DNS server	127.0.0.1 / 8.8.8.8
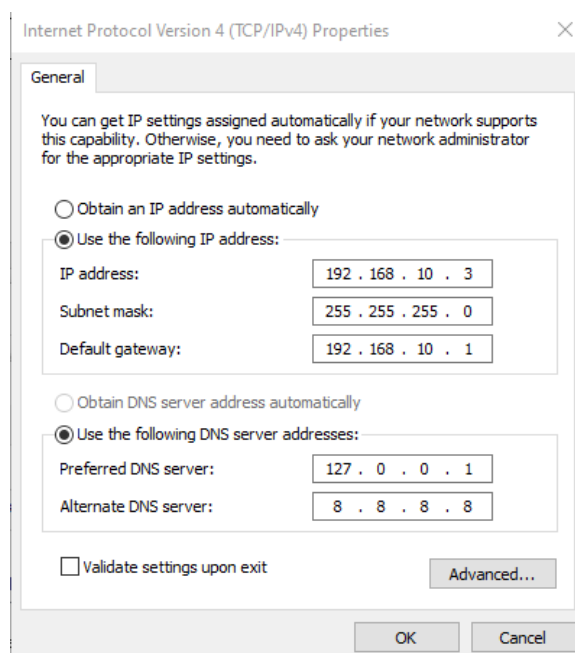
Figure 6. IP settings on client computers

c.   To make arrangements so that each computer in the group can access the internet, you need to set the stage for each device. The following steps are: i) right-click then the new button, and select the folder menu option, ii) give the folder a name whatever we want. Then right-click on the folder. After that, click the properties button, iii) then the properties window will appear, the sharing menu. Then look at the bottom of the network path, click the share button, iv) after that, choose who is allowed to receive the file, and select the everyone option. Where everyone can receive the file. After that, click the add button, v) make sure the option shows the everyone option. Then click the share button, vi) select the read option or you can only read without editing. Then click the share button, vii) go to the sharing menu again, then click the advance sharing button, and viii) click windows + R, then type the computer's IP address. The settings can be seen in Figure 7.
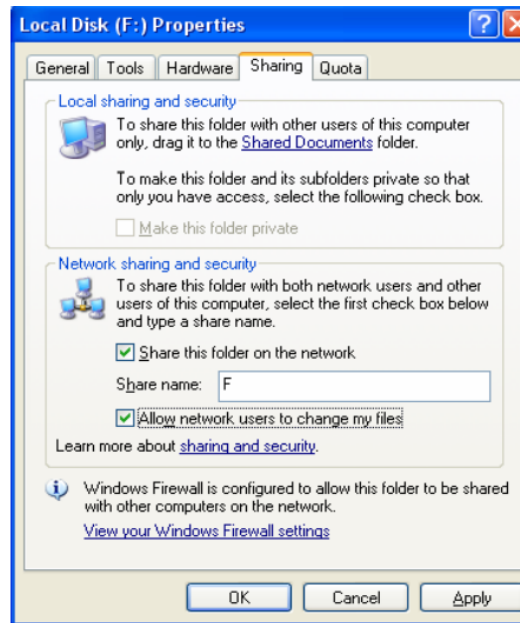
Figure 7. Configuration sharing data on the client's computer

d.   To share resources, such as using a printer, it is necessary to configure the computer that is used as a server, and another computer that is used as a user. On the client's computer, the steps are: i) activate network discovery and file and printer sharing, ii) click the control panel menu, iii) click the network and sharing center menu, iv) click the change advanced sharing settings menu, v) click check the turn on network menu discovery, vi) click check the turn on file and printer sharing menu, and vii) then click the save changes menu. After that, make settings on the server computer, the steps are: i) open the control panel menu, ii) click the devices and printer menu, iii) right-click on the printer you want to share, iv) select the printer properties menu, v) then in the properties window you can click the sharing menu, vi) click the share this printer check mark and you can give it a name according to your wishes, and vii) next you can click OK. The following is the final view of printer sharing as shown in Figure 8.
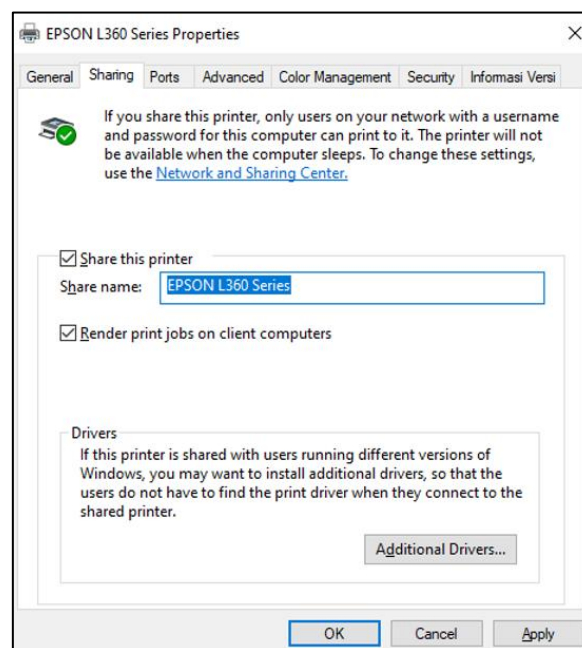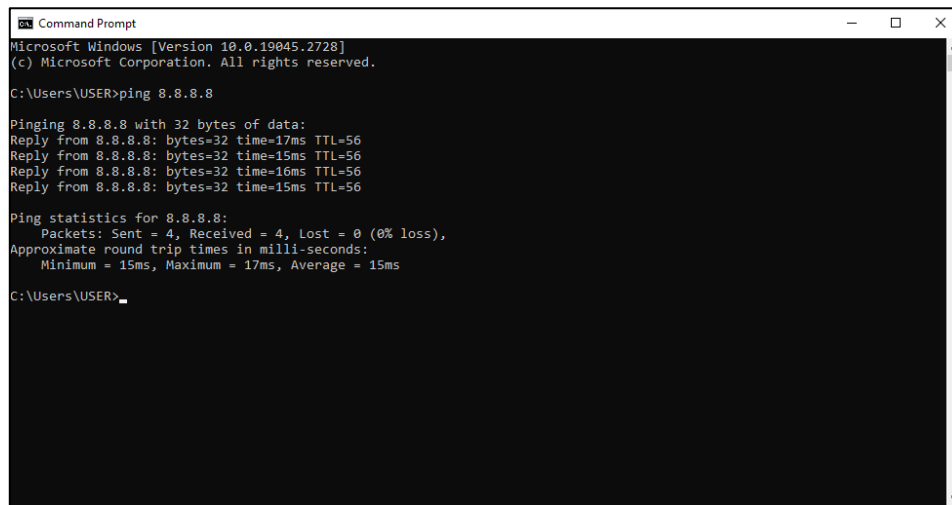
Figure 8. Printer sharing configuration

e. Test whether the device uses the command prompt. In this section the server computer can write down the IP address that has been entered on the client computer, by typing the ping command (followed by the user's IP address). If successful, the display is shown in Figure 9.

Figure 9. Request IP on the client computer from the gateway router

f. So, client computers in each network group can use the printer together, not just through the server computer. And client computers can access the internet simultaneously as shown in Figure 10.
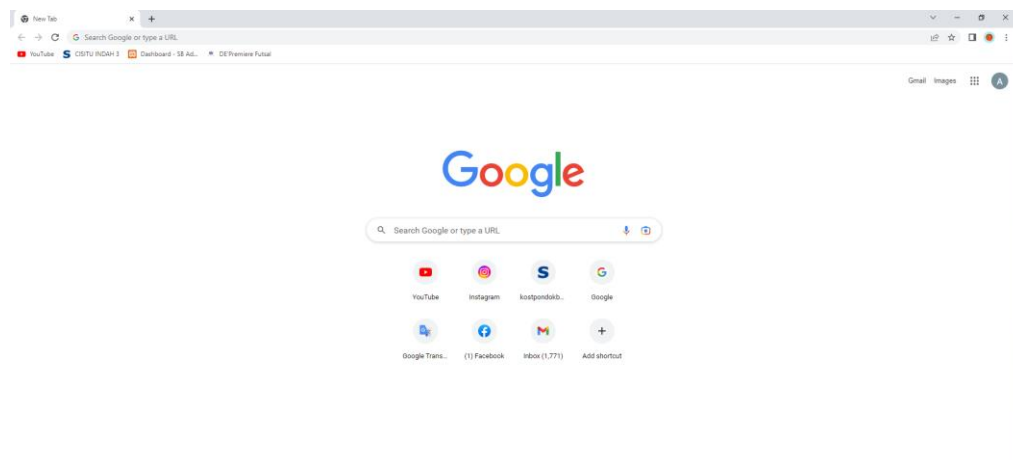
Figure 10. Test the client's computer connection to the internet

4. CONCLUSION

The results of the architectural design of the LAN at the Nurul Jalal Islamic Boarding School can provide an overview of future computer network systems that can be used as a reference for developing good efficient and simple computer networks to implement. To connect with other devices, a switch device is used. The goal is that each switch will connect every part of the Islamic Boarding School. Each device connected to the switch device is assigned its own port. So that network security is more guaranteed and cannot be accessed by any other device.

Meanwhile, server access is provided by only 1 router device. This is done so that the arrangements are carried out centrally. The router device will provide any access, whether data or internet connection, to the switch.

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